

What is claimed is

1 1. A charge-coupled device of XY addressing type,
2 comprising:

3 a light-receiving unit that includes an XY matrix of
4 pixel units in each of which photoelectric transfer and charge
5 accumulation are performed;

6 a pulse generating circuit operable to generate two or
7 more types of voltage pulses; and

8 a shift register operable to

9 (a) start scanning from a first pixel unit that is
10 included in the light-receiving unit, when the two or more
11 types of voltage pulses applied thereto in parallel from the
12 pulse generating circuit are in a first combination, and

13 (b) start scanning from a second pixel unit that is
14 different from the first pixel unit and is included in the
15 light-receiving unit, when the two or more types of the applied
16 voltage pulses are in a second combination that is different
17 from the first combination.

1 2. The charge-coupled device of Claim 1, wherein

2 the pulse generating circuit generates a first voltage
3 pulse, a second voltage pulse, and a third voltage pulse,
4 each having a voltage level set at HIGH level or LOW level,
5 and applies the first voltage pulse, the second voltage pulse,
6 and the third voltage pulse to the shift register, and

7 the first combination is a combination of the first
8 voltage pulse and the second voltage pulse both being set
9 at HIGH level and the third voltage pulse being set at LOW
10 level at a first time point that is before scanning is started,
11 and the second combination is a combination of the second
12 voltage pulse and the third voltage pulse both being set at
13 HIGH level and the first voltage pulse being set at LOW level
14 at the first time point.

1 3. The charge-coupled device of Claim 2, wherein
2 the shift register includes:

3 a first pulse output unit operable to output a first
4 selective pulse indicating to select the first pixel unit
5 from the light-receiving unit;

6 a second pulse output unit operable to output a second
7 selective pulse indicating to select the second pixel unit
8 from the light-receiving unit;

9 a first scanning start unit operable to output, to the
10 first pulse output unit, a first scanning start pulse
11 indicating to start scanning from the first pixel unit, when
12 the first voltage pulse and the second voltage pulse both
13 being set at HIGH level are applied at the first time point;
14 and

15 a second scanning start unit operable to output, to the
16 second pulse output unit, a second scanning start pulse

17 indicating to start scanning from the second pixel unit, when
18 the second voltage pulse and the third voltage pulse both
19 being set at HIGH level are applied at the first time point,
20 the first pulse output unit outputs the first selective
21 pulse, when the first scanning start pulse is applied at the
22 first time point and the third voltage pulse being set at
23 HIGH level is applied at a second time point that follows
24 the first time point, and
25 the second pulse output unit outputs the second selective
26 pulse, when the second scanning start pulse is applied at
27 the first time point and the first voltage pulse being set
28 at HIGH level is applied at the second time point.

1 4. The charge-coupled device of Claim 3, wherein
2 the pulse generating circuit generates a fourth voltage
3 pulse having a voltage level set at HIGH level or LOW level,
4 and applies the fourth voltage pulse to the shift register,
5 the first scanning start unit includes:
6 a first MOSFET, to a drain of which the fourth voltage
7 pulse is applied and to a gate of which the second voltage
8 pulse is applied, where MOSFET stands for Metal Oxide
9 Semiconductor Field Effect Transistor; and
10 a second MOSFET, a drain of which is connected to a source
11 of the first MOSFET and to a gate of which the first voltage
12 pulse is applied, and

13 the first scanning start unit outputs, as the first
14 scanning start pulse, a voltage pulse being set at HIGH level
15 appearing at a source of the second MOSFET, when the fourth
16 voltage pulse being set at HIGH level is applied at the first
17 time point.

1 5. The charge-coupled device of Claim 4, wherein
2 the shift register includes MOSFETs with a single
3 channel.

1 6. The charge-coupled device of Claim 1, wherein
2 in the light-receiving unit, a pixel unit belonging to
3 a first column is the first pixel unit, and a pixel unit
4 belonging to a second column that is different from the first
5 column is the second pixel unit, and
6 the shift register is a horizontal scanning shift
7 register that is placed to extend in an X-axis direction of
8 the light-receiving unit and that scans the light-receiving
9 unit in the X-axis direction.

1 7. The charge-coupled device of Claim 1, wherein
2 the pulse generating circuit generates a first voltage
3 pulse and a second voltage pulse, each having a voltage level
4 set at HIGH level or LOW level, and applies the first voltage
5 pulse and the second voltage pulse to the shift register,

6 and

7 the shift register starts scanning from the first pixel
8 unit when the first voltage pulse being set at HIGH level
9 and the second voltage pulse being set at LOW level are applied
10 at a first time point that is before scanning is started,
11 and starts scanning from the second pixel unit when the first
12 voltage being set at LOW level and the second voltage pulse
13 being set at HIGH level are applied at the first time point.

1 8. The charge-coupled device of Claim 7, wherein

2 in the light-receiving unit, a pixel unit belonging to
3 a first row is the first pixel unit, and a pixel unit belonging
4 to a second row that is different from the first row is the
5 second pixel unit, and

6 the shift register is a vertical scanning shift register
7 that is placed to extend in a Y-axis direction of the
8 light-receiving unit and that scans the light-receiving unit
9 in the Y-axis direction.

1 9. The charge-coupled device of Claim 3, wherein

2 the pulse generating circuit generates a fourth voltage
3 pulse having a voltage level set at HIGH level or LOW level,
4 and applies the fourth voltage pulse to the shift register,
5 and

6 the shift register ends scanning at a last pixel unit

7 that is positioned last in a scanning direction in the
8 light-receiving unit, unless the first voltage pulse and the
9 fourth voltage pulse both being set at HIGH level and the
10 second voltage pulse being set at LOW level are applied at
11 a third time point that is before scanning is ended, and ends
12 scanning at a third pixel unit that is different from the
13 last pixel unit, when the first voltage pulse and the fourth
14 voltage pulse both being set at HIGH level and the second
15 voltage pulse being set at LOW level are applied at the third
16 time point.

1 10. The charge-coupled device of Claim 9, wherein
2 the shift register includes:
3 a third pulse output unit operable to output a third
4 selective pulse indicating to select the third pixel unit
5 from the light-receiving unit;
6 a fourth pulse output unit operable to output a fourth
7 selective pulse indicating to select a fourth pixel unit that
8 is positioned next to the third pixel unit from the
9 light-receiving unit; and
10 a first scanning end unit operable to output, to the
11 fourth pulse output unit, a first scanning end pulse indicating
12 to end scanning at the third pixel unit, when the first voltage
13 pulse and the fourth voltage pulse both being set at HIGH
14 level are applied at the third time point,

15 the third pulse output unit outputs the third selective
16 pulse, when the first voltage pulse being set at HIGH level
17 is applied at the third time point, and

18 the fourth pulse output unit outputs the fourth selective
19 pulse when the first scanning end pulse is not applied at
20 the third time point, and the second voltage pulse being set
21 at HIGH level is applied at a fourth time point that follows
22 the third time point, and does not output the fourth selective
23 pulse when the first scanning end pulse is applied at the
24 third time point even if the second voltage pulse being set
25 at HIGH level is applied at the fourth time point.

1 11. The charge-coupled device of Claim 10, wherein
2 the pulse generating circuit generates a fifth voltage
3 pulse having a voltage level set at HIGH level or LOW level,
4 and applies the fifth voltage pulse to the shift register,
5 the second scanning start unit includes:

6 a first MOSFET, to a drain of which the fifth voltage
7 pulse is applied and to a gate of which the third voltage
8 pulse is applied, where MOSFET stands for Metal Oxide
9 Semiconductor Field Effect Transistor; and

10 a second MOSFET, a drain of which is connected to a source
11 of the first MOSFET and to a gate of which the second voltage
12 pulse is applied,

13 the second scanning start unit outputs, as the second

14 scanning start pulse, a voltage pulse being set at HIGH level
15 appearing at a source of the second MOSFET, when the fifth
16 voltage pulse being set at HIGH level is applied at the first
17 time point,

18 the first scanning end unit includes:

19 a third MOSFET, to a drain of which the fifth voltage
20 pulse is applied and to a gate of which the fourth voltage
21 pulse is applied; and

22 a fourth MOSFET, a drain of which is connected to a source
23 of the third MOSFET and to a gate of which the first voltage
24 pulse is applied, and

25 the first scanning end unit outputs, as the first scanning
26 end pulse, a voltage pulse being set at LOW level appearing
27 at a source of the fourth MOSFET, when the fifth voltage pulse
28 being set at LOW level is applied at the third time point.

1 12. A charge-coupled device of XY addressing type,
2 comprising:

3 a light-receiving unit that includes an XY matrix of
4 pixel units in each of which photoelectric transfer and charge
5 accumulation are performed;

6 a pulse generating circuit operable to generate two or
7 more types of voltage pulses; and

8 a shift register operable to

9 (a) end scanning at a last pixel unit that is positioned

10 last in a scanning direction in the light-receiving unit,
11 when the two or more types of voltage pulses applied thereto
12 in parallel from the pulse generating circuit are in a
13 combination other than a first combination, and

14 (b) end scanning at a first pixel unit that is different
15 from the last pixel unit and is included in the light-receiving
16 unit, when the two or more types of the applied voltage pulses
17 are in the first combination.

1 13. The charge-coupled device of Claim 12, wherein
2 the pulse generating circuit generates a first voltage
3 pulse, a second voltage pulse, and a third voltage pulse,
4 each having a voltage level set at HIGH level or LOW level,
5 and applies the first voltage pulse, the second voltage pulse,
6 and the third voltage pulse to the shift register, and
7 the first combination is a combination of the first
8 voltage pulse and the third voltage pulse both being set at
9 HIGH level and the second voltage pulse being set at LOW level
10 at a first time point that is before scanning is ended.

1 14. The charge-coupled device of Claim 13, wherein
2 the shift register includes:
3 a first pulse output unit operable to output a first
4 selective pulse indicating to select the first pixel unit
5 from the light-receiving unit;

6 a second pulse output unit operable to output a second
7 selective pulse indicating to select a second pixel unit that
8 is positioned next to the first pixel unit from the
9 light-receiving unit; and

10 a first scanning end unit operable to output, to the
11 second pulse output unit, a first scanning end pulse indicating
12 to end scanning at the first pixel unit, when the first voltage
13 pulse and the third voltage pulse both being set at HIGH level
14 are applied at the first time point,

15 the first pulse output unit outputs the first selective
16 pulse when the first voltage pulse being set at HIGH level
17 is applied at the first time point, and

18 the second pulse output unit outputs the second selective
19 pulse when the first scanning end pulse is not applied at
20 the first time point, and the second voltage pulse being set
21 at HIGH level is applied at a second time point that follows
22 the first time point, and does not output the second selective
23 pulse when the first scanning end pulse is applied at the
24 first time point even if the second voltage pulse being set
25 at HIGH level is applied at the second time point.

1 15. The charge-coupled device of Claim 14, wherein
2 the pulse generating circuit generates a fourth voltage
3 pulse having a voltage level set at HIGH level or LOW level,
4 and applies the fourth voltage pulse to the shift register,

5 the first scanning end unit includes:

6 a first MOSFET, to a drain of which the fourth voltage
7 pulse is applied and to a gate of which the third voltage
8 pulse is applied, where MOSFET stands for Metal Oxide
9 Semiconductor Field Effect Transistor; and

10 a second MOSFET, a drain of which is connected to a source
11 of the first MOSFET and to a gate of which the first voltage
12 pulse is applied, and

13 the first scanning end unit outputs, as the first scanning
14 end pulse, a voltage pulse being set at LOW level appearing
15 at the source of the second MOSFET, when the fourth voltage
16 pulse being set at LOW level is applied at the first time
17 point..